



Application of Fuzzy Methods In Assessment of Educational Performance In Rectorate of Surabaya State University

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ABSTRACT

The aim of this research is to analyze employee performance assessments at the Rectorate of Surabaya State University. This research method uses qualitative with literature review. Data sources are studies of relevant journals and books. Data analysis using content analysis. The results of the research state that by calculating the criteria weights using the fuzzy AHP method, it is hoped that the assessment results will be more objective and accurate, which will then provide a picture of the state of the performance of educational staff which can actually be a reference in developing educational staff which will later support performance at PTNBH State University of Surabaya, output This research is in the form of an international journal.

1. INTRODUCTION

UNESA PTNBH is a government Education Institution that is legal entity engaged in higher education. The problem that occurs at UNESA PTNBH is the formulation of the criteria and weight determination of each criteria of the performance assessment form of the employee. This problem causes some employees to feel that performance assessment is now unfair when used as the cornerstone of increase in benefits and positions. From the criteria used in the performance assessment form, it covers several aspects of employee assessment, so there are still other aspects of assessment that are not yet assessed from each employee in each position. The weighting of each criteria is set equal in each position of office, even in one position of office consisting of various jobs has different tasks and responsibilities. This makes the weight of the set performance assessment should be different from each other. This weight difference is to accommodate the tasks and responsibilities of each job in positions of office that are also different, so the results of employee performance assessments are more objective and precise. Both problems can lead to potential underperforming employees in the company because they are dissatisfied and not appreciated by their current assessment system.

The scale of the assessment used by the company has no records or references that are guidelines in granting value on each criteria. This causes the obscure degree of quality of the value range used by UNESA PTNBH. This problem will lead to subjectivity in assessment because everyone has their own qualities to a scale of assessment. This will impact not only on the appraiser but on the assessed employees, as they do not know the value of the scale of the assessment set by the company.

This research is aimed at helping UNESA PTNBH, by creating a new employee performance assessment form, so that the problem of assessing the performance of employees faced can be resolved. And expected results from the assessment are more objective and accurate, which will give an idea of the actual performance state of the employee.

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2. METHODS

Before determining the method to be used in data collection, it is necessary to think about data sources that can be used to identify training needs. Sources of data include; (a) research or surveys (such as those on working conditions, key occurrences, and customer service), (b) performance Appraisal Assessment, (c) Career Planning, (d) Changes in working procedures and technological developments, and (e) HR planning. If the factors to be analyzed are already known and the data sources can be determined, then the designer of the training program can choose the following data collection methods; (a) Questioner, (b) Obervation, (c) Interview, (d) Focus group, (e) Regular meeting, (f) Studying company data, (g) Learn the department description, and (h) Forming a group of experts/advisors. By paying attention to the things described above, the hope is that the training program to be arranged can be successful both in the implementation and when participants return to work to apply the knowledge and skills gained into their daily work. Although not all of the above factors should be analyzed (there are certain training that does not need to analyze all factors), the more data and information that can be collected in the analysis of training needs, the more easy it will be for the designer of the training program to describe the requirements that the company wants, the ability and skills that employees have, the gap between the knowledge, skills and skills that exist and how best to eliminate the gap. By conducting a thorough analysis of training needs, the training program designed will be able to be implemented efficiently and effectively.

3. RESULTS AND DISCUSSIONS

By calculating the weight of the criteria using the AHP fuzzy method is expected the results of the assessment are more objective and accurate, which will later provide an overview of the state of the performance of the educational personnel that can actually be a reference in the development of educational personnel that will later support performance at Surabaya State University of PTNBH, the output of this research in the form of an international journal.

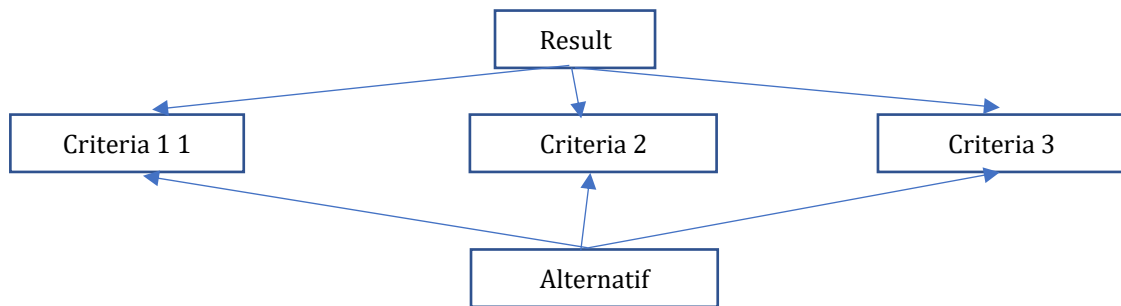


Figure 4. Process Design

From the design of process the carry out, details of the worked details use the fuzzy like the follows:

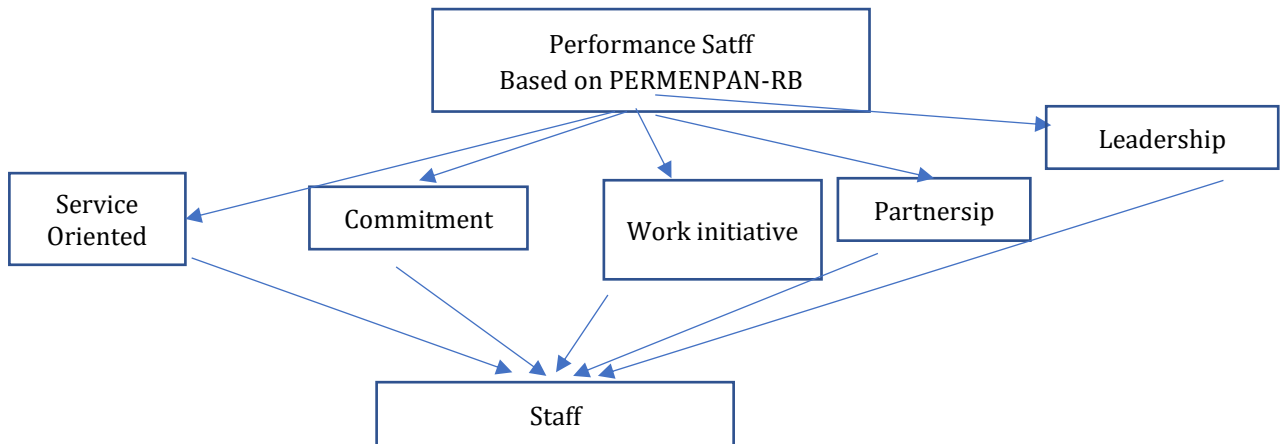


Figure 5. Aspek and Indicator Fuzzy

Tabel 4 Criteria and Alternative

No	Kriteria	Alternatif	Keterangan
1	Service Oriented	Staff	1. Understand and meet the needs of the community. 2. Friendly, deft, soluctive, and reliable. 3. Make endless improvements.
2	Commitment	Staff	1. Perform tasks honestly, responsibly, carefully, and discipline and high integrity. 2. Using state-owned wealth and goods responsibly, effectively and efficiently. 3. Not abusing the authority of the office.
3	Work initiative	Staff	1.Improve self-competence to answer ever-changing challenges. 2. Help others learn. 3. Performing the task of the best quality.
4	Partnersip	Staff	1. Knowing gives different parties the opportunity to contribute. 2. Open in cooperation to generate added value. 3. Move the utilization of various resources for common purposes
5	Leadership	Staff	1. Not abusing the authority of the office. 2. Appreciate everyone whatever their background. 3. I like to help others. 4. Able to build a conducive working environment

The triangular fuzzy number (TFN) can be processed using the Fuzzy (AHP) of algorithm from the Regulations of the Minister of State Apparatus Use and the Reform of the Bureaucracy of the Republic of Indonesia No. 6 Year 2022 on the Performance Management of the State Civil Apparatus Employee on the Performance Manager of the State Civil Apparatus in the form of aspects, indicators, and weights. The triangular number fuzzy (TFN), a fuzzy set notion, supports metrics relating to the subjective evaluation of people using language or linguistics. The central falsehoods in the AHP fuzzy comparison are described using the scale of the rate corresponding to the fuzzy scale. The tri angular number of fuzzy is represented and follows the vittles of class function.

Table 5. Conversions of the interest intensity in variable linguistics.

Absolute Level Of Interest Intensity	Definition	Explanation
1	Equally Crucial	Both activities equally advance the goal.
3	Somewhat more important one over the other	Likes the One of Activities More Than Another
5	Quite important	Likes the One of Activities More Than Another
7	Very important	Strong in Preference for of Activities More Than Another
9	Extreme Interest	Strong preference for one activity over another
2,4,6,8	Values in the Middle of Two Adjacent Decision Values	When Compromise Is Needed
Reverse	If activity i is more valuable than activity j, then j is more valuable in relation to i.	
Ratio	Ratio in Measurement Is Obtained Directly	

From the previous assertion, the following comparison of fuzzy significance scales may be made:

Table 6. Fuzzy importances level comparisohn scales

Level of Fuzzy Scale	Inverse Fuzzy Scale	Definition of Linguistic Variable
(1,1,1)	(1,1,1)	Comparison Using the Same Standards
1=(1/2,1,3/2)	(2/3,1,2)	The Value of Two Elements Is the Same.
3=(1,3/2,2)	(1/2,2/3,1)	One component is marginally more crucial than the others.
5=(3/2,2,5/2)	(2/5,1/2,2/3)	One component is more crucial than the others.
7=(2,5/2,3)	(1/3,2/5,1/2)	One component is more crucial than the others.
9=(5/2,3,7/2)	(2/7,1/3,2/5)	The importance of one absolute element over another is greater.

Grounded on computations of assessment of workers workers using the algorithms using Fuzzy AHP makes it easy to use the data to make a help push the opinions in determining the philanthropist of faculty training. In the final assessment, we get value in the benefactor of faculty development in the form of crucial rankings that will be saved in the database and used for on-the-spot evaluation during the ensuing training process.

Based on our investigation, we were able to obtain the comparison matrix results between the State Civil Apparatus Employee Performance Operation Criteria from the Regulation of Minister of Use of State Apparatus and the Regulatory Reform of the Republic of Indonesia No. 6 of 2022, which are displayed in Table 4.

Table 7. Matrix comparison between criteria.

Kriteria	Service Oriented	Commitment	Work initiative	Partnership	Leadership
Service Oriented	1	3	5	7	9
Commitment	0	1	3	5	7
Work initiative	0	0	1	3	5
Partnership	0	0	0	1	3
Leadership	0	0	0	0	1

The next step is to create a Pairwise Comparisons Between Criteria Matrix by converting the value of pairwise comparisons between criteria. also, the outcomes will be as desired:

Table 8. Pairwises Comparison Matrixs Between Criteria

	(C1) Service Oriented			(C2) Commitment			(C3) Work initiative			(C4) Partnership			(C5) Leadership		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
(C1) Service Oriented	1	1	1	1	1.5	2	2	2.5	3	3	3.5	4	4	4.5	4.5
(C2) Commitment	0.5	0.667	1	1	1	1	1	1.5	2	2	2.5	3	3	3.5	4
(C3) Work initiative	0.333	0.4	0.5	0.5	0.667	1	1	1	1	1	1.5	2	2	2.5	3
(C4) Partnership	0.25	0.286	0.333	0.333	0.4	0.5	0.5	0.667	1	1	1	1	1	1.5	2

(C5) Leadership	0.222	0.222	0.25	0.25	0.286	0.333	0.333	0.4	0.5	0.5	0.667	1	1	1	1
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The Fuzzy of Tri angular Number value will be determined as follows using the Pairwise Comparisons Matrix procedure between the aforementioned criteria:

Table 10 Fuzzy Tri angular Number

	L	M	U
	11	13	14.5
	7.5	9.167	11
	4.833	6.067	7.5
	3.083	3.853	4.833
	2.305	2.575	3.083
	28.721	34.662	40.916

Equation 1. Fuzzy synthesis value formula (Si) to obtain relative weights for decision-making elements

$$\tilde{S}_i = \sum_{j=1}^m \tilde{M}_{ci}^j \odot \left[\sum_{i=1}^n \sum_{j=1}^m \tilde{M}_{ci}^j \right]^{-1}$$

Using equation 1 and subsequent steps to obtain the values of the rows and columns in each comparison matrix, fuzzy conflation values are then obtained for each of the following criteria:

(C1) Service Oriented

(11, 13, 14.5) x (1/40.916, 1/34.662, 1/28.721) = (0.269 0.375 0.505)

(C2) Commitment

(7.5, 9.167, 11) x (1/40.916, 1/34.662, 1/28.721) =(0.183 0.264 0.383)

(C3) Work initiative

(4.833, 6.067, 7.5) x (1/40.916, 1/34.662, 1/28.721) =(0.118 0.175 0.261)

(C4) Partnersip

(3.083, 3.853, 4.833) x (1/40.916, 1/34.662, 1/28.721) =(0.075 0.111 0.168)

(C5) Leadership

(2.305, 2.575, 3.083) x (1/40.916, 1/34.662, 1/28.721) =(0.056 0.074 0.107)

Equation 2: The membership degrees formula derived from fuzzy synthesis value comparisons to obtain a vector. The procedure is as follows:

$$V(M_2 \geq M_1) = \begin{cases} 1 & , \text{jika } m_2 \geq m_1 \\ 0 & , \text{jika } l_1 \geq u_2 \\ \frac{(l_1 - u_2)}{(m_2 - u_2) - (m_1 - l_1)} & , \text{yang lainnya.} \end{cases} \quad \text{Equation 2}$$

Table 11 Nilai Sintesis Fuzzy untuk Kriteria

	l	m	u
Service Oriented	0.269	0.375	0.505
Commitment	0.183	0.264	0.383
Work initiative	0.118	0.175	0.261
Partnersip	0.075	0.111	0.168
Leadership	0.056	0.074	0.107

The next step is to identify each criterion's class level. The class grade was calculated using equation 2. By comparing two fuzzy conflation values and taking the minimum with the following equation, the values of the class degrees will be calculated.

$$d'(A_i) = \min V (S_i \geq S_k)$$

Using the calculations below: Efficiency criteria are compared to other criteria:

$$C_1 \geq C_2 = 1$$

$$C_1 \geq C_3 = 1$$

$$C_1 \geq C_4 = 1$$

$$C_1 \geq C_5 = 1$$

Then obtained:

$$d'(\text{Service Oriented})$$

$$= \min (1, 1, 1, 1)$$

$$= 1$$

Effective Criteria versus Other Criteria Comparison:

$$C_2 \geq C_1 = 0.507$$

$$C_2 \geq C_3 = 1$$

$$C_2 \geq C_4 = 1$$

$$C_2 \geq C_5 = 1$$

Then obtained:

$$d'(\text{Comittment})$$

$$= \min (0.507, 1, 1, 1)$$

$$= 0.507$$

Effective Criteria in Relation to Other Criteria:

$$C_3 \geq C_1 = 0$$

$$C_3 \geq C_2 = 0.467$$

$$C_3 \geq C_4 = 1$$

$$C_3 \geq C_5 = 1$$

Afterward, I got: $d'(\text{Work initiative})$

$$= \min (0, 0.467, 1, 1)$$

$$= 0$$

Effective Criteria in Relation to Other Criteria:

$$C_4 \geq C_1 = 0$$

$$C_4 \geq C_2 = 0$$

$$C_4 \geq C_3 = 0.439$$

$$C_4 \geq C_5 = 1$$

Then obtained:

$$d'(\text{Partnersip})$$

$$= \min (0, 0, 0.439, 1)$$

$$= 0$$

Effective Criteria in Relation to Other Criteria:

$$C_4 \geq C_1 = 0$$

$$C_4 \geq C_2 = 0$$

$$C_4 \geq C_3 = 0$$

$$C_4 \geq C_5 = 0.464$$

Then obtained:

$$d'(\text{Leadership})$$

$$= \min (0, 0, 0, 0.464)$$

$$= 0$$

$$W' = (d'(A_1), d'(A_2), \dots, d'(A_n))^T$$

Equation 3

The values of the degree of class are determined from the computation above by comparing each criterion; the minimum is also chosen using equation 3; and the vector weights for the criteria are determined, as shown below:

$$W \setminus = (1, 0.507, 0, 0, 0)T$$

The next step is to decide how the vector weights should be normalized for each criterion, and then the normalization of the vector weights will be completed.

Additionally, the vector weights are normalized by dividing each element in W' by the sum of its rudiments.

The criteria's vector weights(W') are

$$W \setminus = (1, 0.507, 0, 0, 0)$$

With the total number of elements in W\ ' is:

$$1 + 0.507 + 0 + 0 + 0 = 1.507$$

So the normalized vector weight is:

$$W \setminus = (1/1.507, 0.507/1.507, 0/1.507, 0/1.507, 0/1.507)T \\ = (0.664, 0.336, 0, 0, 0)T$$

Table 12 Normalization of Vector Weights for Criteria

Criteria	(C1) Service Oriented	(C2) Commitment	(C3) Work initiative	(C4) Partnersip	(C5) Leadership	TOTAL
W\ '	1	0.507	0	0	0	1.507
W	0.664	0.336	0	0	0	1

The coming process is ranking. To arrive at a decision from identifying the fashionable employees, a ranking process is used. The total ranking, as in the AHP system, is obtained by adding the assessment criteria of each employee's volition and the weight factor. The employees' choices are as follows.

Table 13 Weight Of Criteria Value

DESCRIPTION	WEIGHT VALUE
VERY GOOD	1
GOOD	0.75
ENOUGH	0.5
LESS	0.25
VERY LESS	0

The input weighting factors for each evaluation are then considered, and they can be verified by workers. Example survey findings using questionnaires comparable to those in Excursus 2 are as follows:

Table 14 Weighting of Criteria Values for Each Alternative

	(C1) Service Oriented	(C2) Commitment	(C3) Work initiative	(C4) Partnersip	(C5) Leadership
Abdul Aziz	GOOD	ENOUGH	GOOD	VERY LESS	VERY LESS
Rindu Melati	VERY GOOD	VERY LESS	ENOUGH	LESS	ENOUGH
Muhammad Ridwan	GOOD	GOOD	VERY GOOD	LESS	VERY GOOD
Bambang	LESS	GOOD	VERY GOOD	GOOD	VERY GOOD
Sulastri	ENOUGH	VERY GOOD	VERY GOOD	LESS	VERY GOOD

Rinto Suroto	VERY LESS	GOOD	LESS	VERY LESS	ENOUGH
Wawan	LESS	GOOD	VERY LESS	VERY GOOD	LESS
Susi Susanti	LESS	ENOUGH	GOOD	VERY LESS	GOOD
Samuel	LESS	VERY LESS	VERY LESS	VERY LESS	LESS
Rini Suliswati	VERY LESS	ENOUGH	VERY LESS	ENOUGH	ENOUGH
Purnama Sinaga	LESS	VERY GOOD	LESS	VERY LESS	ENOUGH

The input weighting criterion values from each alternative are then converted, as follows:

Table 15 Conversion of Criteria Weighting Value of Each Alternative

	(C1) Service Oriented	(C2) Commitment	(C3) Work initiative	(C4) Partnersip	(C5) Leadership
Abdul Aziz	0.75	0.5	0.75	0.00	0.00
Rindu Melati	1.00	0.00	0.5	0.25	0.5
Muhammad Ridwan	0.75	0.75	1.00	0.25	1.00
Bambang	0.25	0.75	1.00	0.75	1.00
Sulastri	0.5	1.00	1.00	0.25	1.00
Rinto Suroto	0.00	0.75	0.25	0.00	0.5
Wawan	0.25	0.75	0.00	1.00	0.25
Susi Susanti	0.25	0.5	0.75	0.00	0.75
Samuel	0.25	0.00	0.00	0.00	0.25
Rini Suliswati	0.00	0.5	0.00	0.5	0.5
Purnama Sinaga	0.25	1.00	0.25	0.00	0.5

The weights of the criterion with alternatives are then calculated, with the following outcomes:

Table 16 Criteria Weights with Alternatives

	(C1) Service Oriented	(C2) Commitment	(C3) Work initiative	(C4) Partnersip	(C5) Leadership	Total
Abdul Aziz	0.498	0.168	0	0	0	0.666
Rindu Melati	0.664	0	0	0	0	0.664
Muhammad Ridwan	0.498	0.252	0	0	0	0.75
Bambang	0.166	0.252	0	0	0	0.418
Sulastri	0.332	0.336	0	0	0	0.668
Rinto Suroto	0	0.252	0	0	0	0.252
Wawan	0.166	0.252	0	0	0	0.418
Susi Susanti	0.166	0.168	0	0	0	0.334
Samuel	0.166	0	0	0	0	0.166
Rini Suliswati	0	0.168	0	0	0	0.168
Purnama Sinaga	0.166	0.336	0	0	0	0.502

Table 17 Alternative Ranking Order

Rank	Alternative	Total
1	Muhammad Ridwan	0.75
2	Sulastri	0.668
3	Abdul Aziz	0.666
4	Rindu Melati	0.664
5	Purnama Sinaga	0.502
6	Bambang	0.418
7	Wawan	0.418
8	Susi Susanti	0.334
9	Rinto Suroto	0.252
10	Rini Suliswati	0.168
11	Samuel	0.166

Discussion

From the results of the calculation above, it will be done a ranking where employees have the highest and best value to be proposed in following competency training. The following professions:

Table 18 Table of Profession

No	Sort of Profession
1	Appraisal
2	Accountant
3	Data Analist
4	Technician and construction
5	Environmentalist
6	Technician and construction
7	ADVOKAT
8	Procurement Expert
9	BRAND ANALIS Business
10	Risk management Expertist
11	Architecture
12	Other Profession

4. CONCLUSION

The following conclusions can be taken from the previous chapters' examination and discussion of the research's findings Fuzzy implementation has an effect on making decisions. Hypotheses and propositions can be proven by the influence between the two variables, namely the implementation of fuzzy on decision making in the selection of competency training candidates. This condition reflects that the more fans of training the process will be more complicated and difficult in deciding the best or inefficient implementers. With fuzzy makes it easier to make decisions who executives or recipients of competency training, the easier it is to make decisions, the more efficiency is to lower administrative costs so that it is appropriate and appropriate to save budget.

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